

REMARKS

Claims 1, 9, and 15 have been amended. Claims 1 through 15 remain in the application.

In the last Office Action, claims 1 through 15 were rejected under 35 U.S.C. § 103 as being unpatentable over “Simulation and Production Planning for Manufacturing Cells” by Shahram Taj et al. in view of “Emulation of a Material Delivery System by Todd LeBaron et al. Applicants respectfully traverse this rejection.

The “Simulation and Production Planning for Manufacturing Cells” by Shahram Taj et al. discloses that simulation is used to verify the feasibility of the design of manufacturing cells. The purpose of this study was to show how simulation can be used to examine the feasibility of converting an existing system to a cellular manufacturing system at a component manufacturer for a major automotive company. An ideal lean cell (shown schematically in Figure 1) would have all machines needed to process a part located very close together, single-piece flow of parts between operations, and operators running multiple machine types. A schematic of this cell is shown in Figure 2, showing the general layout including the number of machines for each operation (8 machines for OP 60 for example). Figure 3 shows the operator standard work chart for a medium sized cell. Simulation analysis was used to verify the cell design in terms of production feasibility. The new cell design was modeled in Witness. The LABOR element in Witness is used to represent the operator. In Witness, LABOR is a resource like a human operator or tools which may be required by other elements for processing, setting up, repair or loading. Taj et al. does not disclose constructing a flowchart that describes interaction of an operator in a workcell using a computer wherein such interaction comprises sequential operations and asynchronous operations, modeling the operator as an input to a programmable logic controller (PLC) by writing a control model of the operator interaction in the

workcell based on predefined conditions described in the flowchart, and testing the control model by a PLC logical verification system on the computer as to whether PLC logic for the workcell is correct.

The “Emulation of a Material Delivery System by Todd LeBaron et al. discloses that emulation is the process of exactly imitating a real system. Recent advances in simulation technology make it possible to emulate real world control systems by using a system’s control logic to interact with a simulation model. Routing logic, PLC or PC control software, sequencing algorithms, and more can be integrated, tested, and debugged within a simulation environment. Emulation provides the graphical and statistical output needed to accurately evaluate different algorithms and control logic. LeBaron et al. does not disclose constructing a flowchart that describes interaction of an operator in a workcell using a computer wherein such interaction comprises sequential operations and asynchronous operations, modeling the operator as an input to a programmable logic controller (PLC) by writing a control model of the operator interaction in the workcell based on predefined conditions described in the flowchart, and testing the control model by a PLC logical verification system on the computer as to whether PLC logic for the workcell is correct.

In contradistinction, independent claim 1, as amended, clarifies the invention claimed as a method of logical modeling operator interaction with a programmable logic controller logical verification system. The method includes the steps of constructing a flowchart that describes interaction of an operator in a workcell using a computer wherein such interaction comprises sequential operations and asynchronous operations. The method also includes the steps of modeling the operator as an input to a programmable logic controller (PLC) by writing a control model of the operator interaction in the workcell based on predefined conditions described in the flowchart. The method includes the steps of testing the control model by a PLC

logical verification system on the computer as to whether PLC logic for the workcell is correct. The method further includes the steps of loading the PLC logic in the PLC controlling the workcell if the PLC logic for the workcell is correct and using the PLC logic by the PLC to operate the workcell. Independent claims 9 and 15 have been amended similar to claim 1 and include other features of the present invention.

The United States Court of Appeals for the Federal Circuit (CAFC) has stated in determining the propriety of a rejection under 35 U.S.C. § 103, it is well settled that the obviousness of an invention cannot be established by combining the teachings of the prior art absent some teaching, suggestion or incentive supporting the combination. See In re Fine, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988); Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 227 U.S.P.Q. 657 (Fed. Cir. 1985); ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 221 U.S.P.Q. 929 (Fed. Cir. 1984). The law followed by our court of review and the Board of Patent Appeals and Interferences is that “[a] prima facie case of obviousness is established when the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art.” In re Rinehart, 531 F.2d 1048, 1051, 189 U.S.P.Q. 143, 147 (C.C.P.A. 1976). See also In re Lalu, 747 F.2d 703, 705, 223 U.S.P.Q. 1257, 1258 (Fed. Cir. 1984) (“In determining whether a case of prima facie obviousness exists, it is necessary to ascertain whether the prior art teachings would appear to be sufficient to one of ordinary skill in the art to suggest making the claimed substitution or other modification.”)

None of the references cited, either alone or in combination, teaches or suggests the claimed invention of claims 1 through 15. Specifically, Taj et al. merely discloses that simulation is used to verify the feasibility of the design of manufacturing cells in which a new cell design was modeled in Witness with the LABOR element in Witness being used to represent

the operator, which is like a human operator or tools which may be required by other elements for processing, setting up, repair or loading. Taj et al. lacks constructing a flowchart that describes interaction of an operator in a workcell using a computer wherein such interaction comprises sequential operations and asynchronous operations, modeling the operator as an input to a programmable logic controller (PLC) by writing a control model of the operator interaction in the workcell based on predefined conditions described in the flowchart, and testing the control model by a PLC logical verification system on the computer as to whether PLC logic for the workcell is correct. In Taj et al., Witness describes the operator as a set of tasks that are time based and there are no asynchronous operations of the operator. Also, Witness is not used for modeling an operator as an input to a programmable logic controller (PLC). Further, Witness is not used to debug PLC logic.

LeBaron et al. merely discloses that emulation is the process of exactly imitating a real system in which routing logic, PLC or PC control software, sequencing algorithms, and more can be integrated, tested, and debugged within a simulation environment. LeBaron et al. lacks constructing a flowchart that describes interaction of an operator in a workcell using a computer wherein such interaction comprises sequential operations and asynchronous operations, modeling the operator as an input to a programmable logic controller (PLC) by writing a control model of the operator interaction in the workcell based on predefined conditions described in the flowchart, and testing the control model by a PLC logical verification system on the computer as to whether PLC logic for the workcell is correct. In LeBaron et al., there is a discrete event simulator, which is time based, and cannot account for asynchronous operations. Further, there is no modeling of an operator as an input to a programmable logic controller (PLC). As such, there is no suggestion or motivation in the art to combine Taj et al. and LeBaron et al. together.

As to the level of ordinary skill in the pertinent art, in Taj et al., Witness is used to represent the operator as a series of tasks that are time dependent. In LeBaron, a discrete event simulator is used for time dependent events and does not allow for asynchronous operations, which are not time dependent. Further, neither reference allows for modeling of an operator as an input to a programmable logic controller (PLC). As such, there is absolutely no teaching of a level of skill in the programmable logic controller art that a method of logical modeling operator interaction with a programmable logic controller logical verification system includes the steps of constructing a flowchart that describes interaction of an operator in a workcell using a computer wherein such interaction comprises sequential operations and asynchronous operations, modeling the operator as an input to a programmable logic controller (PLC) by writing a control model of the operator interaction in the workcell based on predefined conditions described in the flowchart, and testing the control model by a PLC logical verification system on the computer as to whether PLC logic for the workcell is correct. The Examiner may not, because he doubts that the invention is patentable, resort to speculation, unfounded assumptions or hindsight reconstruction to supply deficiencies in the factual basis. See In re Warner, 379 F. 2d 1011, 154 U.S.P.Q. 173 (CCPA 1967).

The present invention sets forth a unique and non-obvious combination of a method for logical modeling of operator interaction with a programmable logic controller logical verification system that allows a user to verify that the PLC code being planned will work as intended, prior to physically building the tools/manufacturing line and locating equipment. Unlike the prior art, the focus of the present invention is on the logical representation of the operator and not the visual or spatial representations of the operator.

The references, if combinable, fail to teach or suggest the combination of a method of logical modeling operator interaction with a programmable logic controller logical

verification system including the steps of constructing a flowchart that describes interaction of an operator in a workcell using a computer wherein such interaction comprises sequential operations and asynchronous operations, modeling the operator as an input to a programmable logic controller (PLC) by writing a control model of the operator interaction in the workcell based on predefined conditions described in the flowchart, testing the control model by a PLC logical verification system on the computer as to whether PLC logic for the workcell is correct, loading the PLC logic in the PLC controlling the workcell if the PLC logic for the workcell is correct, and using the PLC logic by the PLC to operate the workcell as claimed by Applicants.

Further, the CAFC has held that “[t]he mere fact that prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification”. In re Gordon, 733 F.2d 900, 902, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984). The Examiner has failed to show how the prior art suggested the desirability of modification to achieve Applicants’ invention. Thus, the Examiner has failed to establish a case of prima facie obviousness. Therefore, it is respectfully submitted that claims 1 through 15 are allowable over the rejection under 35 U.S.C. § 103.

Obviousness under § 103 is a legal conclusion based on factual evidence (In re Fine, 837 F.2d 1071, 1073, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988), and the subjective opinion of the Examiner as to what is or is not obvious, without evidence in support thereof, does not suffice. Since the Examiner has not provided a sufficient factual basis, which is supportive of his/her position (see In re Warner, 379 F.2d 1011, 1017, 154 U.S.P.Q. 173, 178 (C.C.P.A. 1967), cert. denied, 389 U.S. 1057 (1968)), the rejection of claims 1 through 15 is improper. Therefore, it is respectfully submitted that claims 1 through 15 are allowable over the rejection under 35 U.S.C. § 103.

Based on the above, it is respectfully submitted that the claims are in a condition for allowance, which allowance is solicited.

Respectfully submitted,

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